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ABSTRACT

A brief description is given of an inertialess method of recording pulse which the author has applied for the past two years and which utilizes the I. T. Akulinevich electronic cardi^oscope and a piezoelectric sensor as the receptor.

In spite of the unquestionable importance and value of sphygmography ^{/83*} indicators to diagnostics, it is not yet widely used in the clinic. The reason for this is that the "code" contained on the sphygmogram is still insufficiently clear and its many interpretations are still controversial; in addition to this the existing devices for the graphical recording of the pulse are imperfect (in particular, they possess inertia) and do not satisfy the requirements imposed on them. This serves as a basis for research and development of new methods of sphygmography, including methods utilizing inertialess recording systems such as the electrocardiograph or the electron oscilloscope.

In the last two years we applied an inertialess method of recording pulse using the I. T. Akulinevich vectorcardi^oscope with a piezoelectric sensor as the receptor.

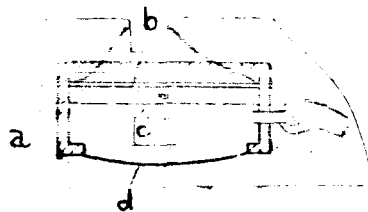


Figure 1. Schematic of the piezoelectric sensor.
a, metallic capsule; b, piezoelectric crystal; c,
metallic membrane; d, rubber membrane

*Numbers given in margin indicate pagination in original foreign text.

The sensor of our design consists of a metallic capsule with a piezoelectric plate (crystal) attached to its base with contacts extending out. The plate is rigidly connected to a thin metallic membrane situated inside the capsule. The external part of the capsule is covered with a rubber membrane and its cavity is connected to a manometer by means of a rubber tube and to a rubber bulb, which makes it possible to change the pressure in the capsule (fig. 1).

An attachment installed between the sensor and the vectorcardiograph consists of a plastic box with two rows of sockets for single-pole plugs. One row is designed for leads from the sensor while the other is for the leads from the vectorcardiograph. The inside of the box contains a composition potentiometer $R - 470 \Omega$ and condensers $C_1 - 0.05 \mu F$ and $C_2 - 0.02 \mu F$ at the input and output of the electric current (fig. 2).

The potentiometer is designed to control the amplitude of electric pulses generated by the sensor. The condensers "smooth out" the high-frequency oscillations produced by interference. All the parts mentioned above are mounted together in a single device.

The pulse is recorded in the following manner. The sensor is placed over the region of the pulse and secured with a cloth tape. The rubber bulb is used to pump air into the capsule using the manometer to control the pressure and to set it at 30 mm Hg. At this time the rubber membrane is firmly pressed to the region of the pulse. The leads from the piezoelectric sensor and the leads from the vectorcardiograph are both connected to the attachment. After this, the vectorcardiograph is turned on.

The pulse oscillations of the elastic membrane are transmitted through the thin layer of air inside the capsule to the metallic membrane and to the piezoelectric crystal producing electrical impulses in the latter. These impulses, fed to the vectorcardiograph, cause the cathode tube ray to trace out with persistence the pulse curves, which can be observed for a prolonged period of time and photographed.

The device makes it possible to record the pulse from various regions of the body (figs. 3, 4, 5) and to compare the sphygmogram and electrocardiogram on one curve which in turn makes it possible to determine the speed of pulse-wave propagation along the vessels (fig. 6).

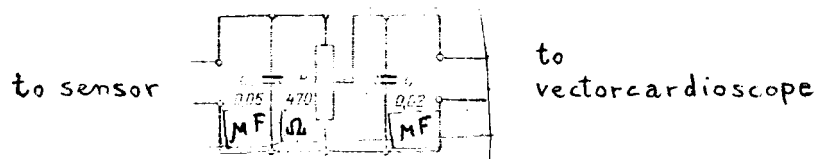


Figure 2. Schematic of the attachment

Thus the method described by us accomplishes the graphical recording of the pulse from the radial, temporal, femoral and other arteries and maintains constant conditions necessary for obtaining comparative data on the amplitude and shape of the pulse wave and the propagation speed from the heart to the periphery. It opens wider possibilities in the study of sphygmography and its utilization for purposes of diagnostics.



Figure 3. Sphygmogram of the right radial artery

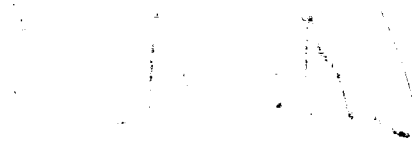


Figure 4. Sphygmogram of the right temporal artery

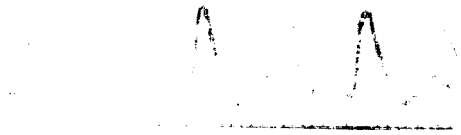


Figure 5. Sphygmogram of the rear artery of the right foot

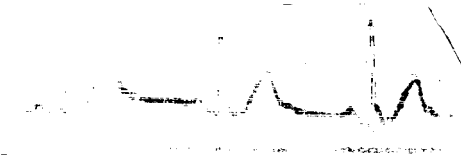


Figure 6. Sphygmogram of the right radial artery in conjunction with the EKG according to the II removal.